Mapping Spatial Frequency Preferences in the Human Visual Cortex

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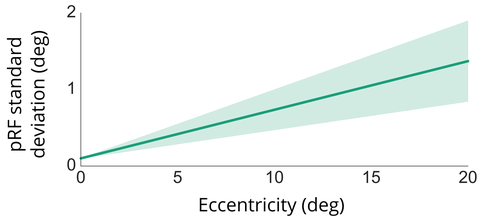
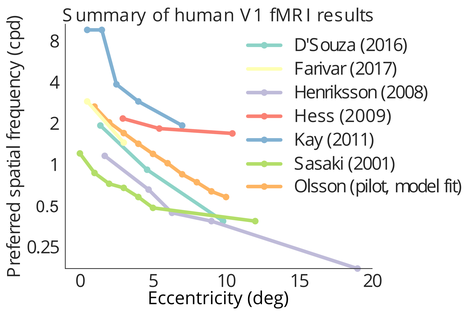
How do spatial frequency preferences change with eccentricity?

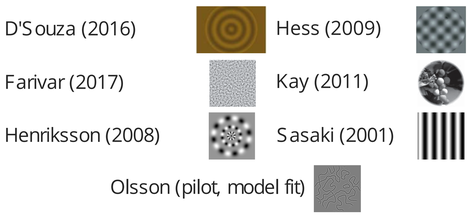
- V1 population receptive field (pRF) size grows linearly with eccentricity[1]



- Previous results show peak spatial frequency decreases with eccentricity, but actual numbers vary by two to three octaves!



- Variability perhaps due to inconsistent stimuli



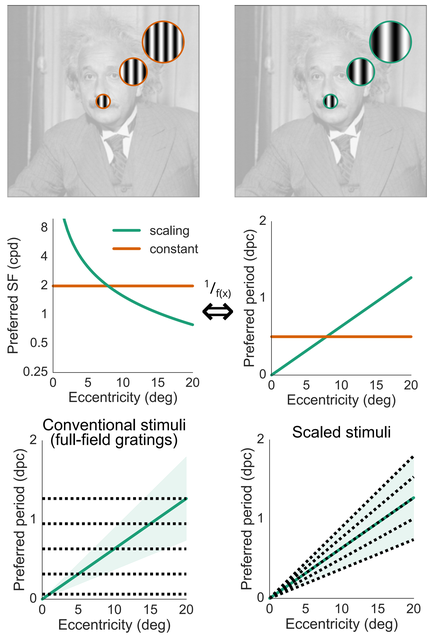
References

1. Replotted from Benson, et al. (2018). bioRxiv. http://dx.doi.org/10.1101/308247
2. Kay, K. N., et al. (2013). Frontiers in Neuroscience. http://dx.doi.org/10.3389/fnins.2013.00247
3. Benson NC, Winawer J (2018). In Preparation.

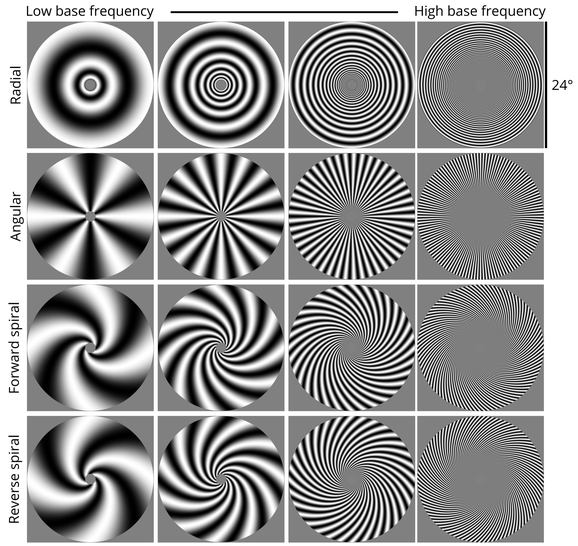
Extreme Possibilities

SF preferences **constant** across visual field

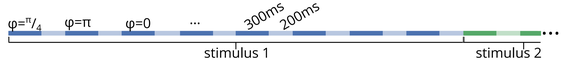
SF preferences **scale** with eccentricity



Stimuli and Task

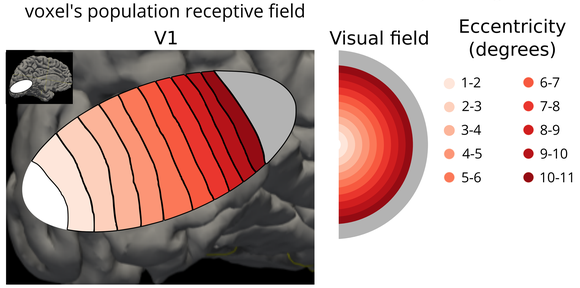


- 40 stimulus classes (10 base frequencies, 4 types), 8 phases (φ) per class
- Presented once in each of 12 runs in random order
- 1-back task on digit stream at fixation

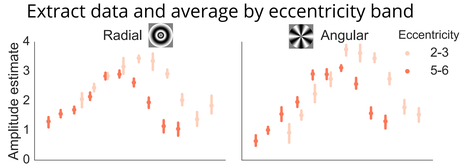


Analysis

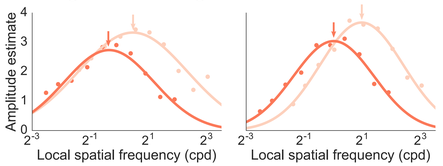
- GLMdenoise[2] to estimate a (bootstrapped) response amplitude per voxel per stimulus
- Bayesian retinotopy[3] to estimate an eccentricity and angle for each voxel's population receptive field



Extract data and average by eccentricity band

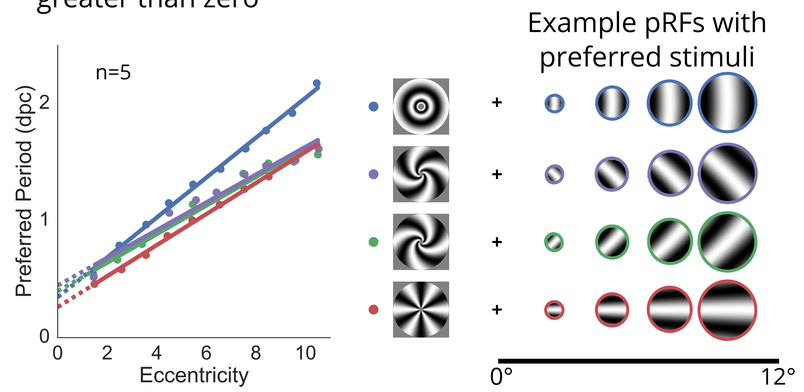


Fit log-normal tuning curve to each bootstrap

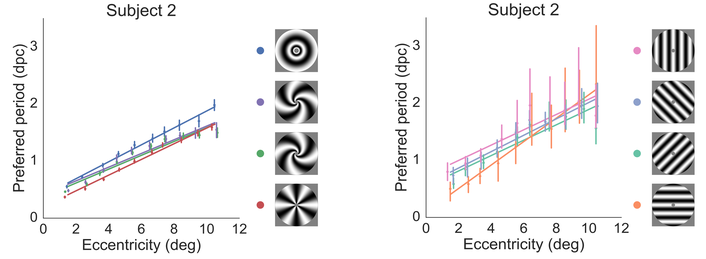


V1 preferred period grows linearly with eccentricity

- This relationship is close to, but not exactly, **scaling**: preferred period is linear with eccentricity, but with intercept greater than zero



- Conventional full-field gratings produce similar results, but with much larger error bars



- Subjects all show similar patterns